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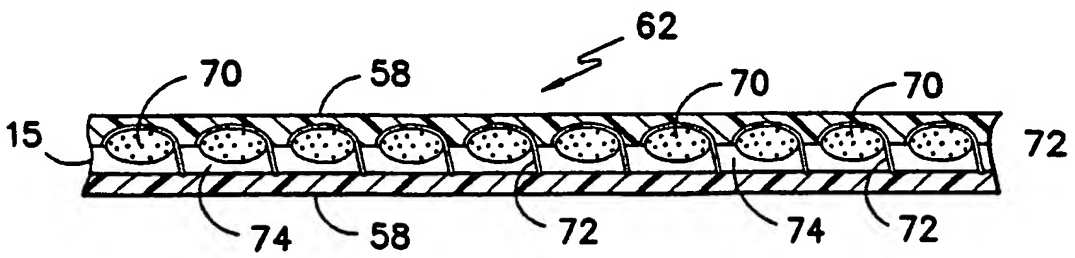
(54) Title: CALENDERED WEFT INSERTED WARP KNIT FABRIC



(57) Abstract: A warp knit, weft inserted fabric (62) having the face thereof calendered to produce a fabric when a PVC film is laminated thereto that has a surface roughness of 2.0 microns or below.

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Description

CALENDERED WEFT INSERTED WARP KNIT FABRIC

Technical Field

This invention relates generally to a coated or laminated fabric which can be printed evenly and clearly on both sides and in particular to a calendered weft inserted warp knit fabric for such use in laminated or coated fabrics or applications.

Background Art

Prior to this invention, weft inserted, warp knit fabrics were supplied to the customer generally in the condition that it comes off the knitting machine and the customer usually applied any further treatment required by them for their particular use. Warp knit farics with weft inserted yarns therein generally provided a face side which was rough and uneven due to the weft inserted yarns which did not allow good adhesion for a film or other substance to be laminated or coated thereon.

Therefore the object of the invention is to provide a warp knit, weft inserted fabric which when coated or laminated provides excellent adhesion as well as printability.

Other objects and advantages of the invention will become readily apparent as the specification proceeds to describe the invention in detail with reference to the accompanying drawings in which:

Figure 1 is a schematic representation of the process of treating the warp knit, weft inserted fabric;

Figure 2 is a schematic representation of the process to laminate the fabric treated in Figure 1;

Figure 3 is a cross-section of the fabric produced by the treatments shown in Figures 1 and 2;

Figures 4 and 5 are schematic representations of the equipment used to measure surface roughness of a fabric;

Figure 6 is a table comparing surface roughness of an untreated and a treated warp knit, weft inserted fabric; and

Figures 7 and 8 represent, respectively, a running graph of the measurements made by the equipment of Figures 4 and 5 on the untreated and treated fabric.

Looking now to the drawings and especially to Figure 1, a roll of warp knit, weft inserted fabric 10 is shown being processed and taken-up on the surface driven roll 12. The preferred warp knit, weft inserted fabric is a two bar, 100% polyester fabric having a 70 denier multifilament stitch yarn, a 1000 denier multifilament warp yarn and a 1000 denier multifilament weft inserted yarn.

The fabric 14 from the supply roll 10 is supplied over a series of guide rolls 16, 18, 20 and 22 to the calendering machine 24 wherein the face of the fabric 14 is calendered between the heated steel roll 26 and the rubber coated roll 28 wherein the weft inserted yarn 74 is crushed to provide a smooth face. From the calendering machine 24 the calendered fabric 15 is guided by the rubber roll 32 to the inspection machine 34 and then, after inspection, is guided by another series of rolls 36, 38, 40 and 42 to the take-up roll 12 driven by the surface drive rolls 44 and 46.

In the preferred form of the invention the face calendered fabric 15 is taken-up

on the take-up roll 12 and delivered to the machine shown in Figure 2 but obviously, if desired, the face calendered fabric 15 could be delivered continuously in line with machine in Figure 2. From the roll 12 the face calendered fabric 15 is guided into the nip of heated steel rolls 48 and 50 by a series of idler rolls 52, 54 and 56 wherein it is mated with a PVC thermoplastic film 58 from rolls 60 to provide the coated fabric 62 shown in Figure 3. From the nip of calender rolls 48 and 50, the coated fabric 62 is taken upon a take-up roll 64 driven by surface drive rolls 66 and 68.

The fabric 62, as shown in Figure 3, consists of the outer PVC film layers 58 and the calendered warp knit, weft inserted fabric 15 consisting of warp yarns 70, stitch yarns 72 and weft inserted yarns 74. The fabric 62, in the preferred form of the invention is 19 – 20 mils thick with each of the films 58 being approximately 5 mils thick. This particular fabric is desirably used as a banner fabric which can be printed on both sides due to the evenness or smoothness of the face of the warp knit, weft inserted fabric.

To measure the surface roughness of the face of the calendered warp knit, weft inserted fabric after it has been laminated to the film, the surface tester machine 76 shown in Figures 4 and 5 is used to obtain the data shown in Figure 6 and the graphs of Figures 7 and 8. The surface roughness tester machine illustrated is a KES-FB-4 machine sold by Kato-Tekko Co., Ltd. of Kyoto, Japan.

The sample 78 of the fabric 62 to be tested is clamped at one end to the winding drum 80 by chuck 82 and to the chuck 84 at the other end. A transducer (not shown) is hooked to the cage 86 to record the up and down movement thereof as dictated by the finger 88 as it senses the face of the fabric sample 78 as it moves back

and forth thereunder by rotation of the winding drum.

Looking at Figure 6 the mean deviation in microns of the warp knit, weft inserted fabric before and after calendered as shown in Figure 1 and treated as in Figure 2 is shown with the face of the calendered fabric A having a surface roughness of less than 2.0 microns whereas the face of the sample fabric coated without calendering had a surface roughness almost four times greater. Note the difference in amplitude of the face of the non-calendered fabric in Figure 7 versus that of the calendered fabric in Figure 8. It is clearly evident that the fabric of Figure 8 is very smooth which increases the adhesion of the warp knit fabric to the film as well as enhancing the printability on the surface thereof.

It is abundantly clear that the calendered warp knit, weft inserted fabric has a face with a surface roughness of less than 2.0 microns which can readily be used as a banner fabric on which the face could be printed or in other applications such as a substrate for roofing fabric where adhesion and thickness is a factor or in a tenting fabric where smoothness thereof makes it more readily cleanable. As indicated the use of the warp knit, weft inserted fabric for the production of banner material is the preferred use thereof but other suitable uses may be made thereof where a low surface roughness below 2.0 microns is necessary to provide a viable product.

The above described embodiment is given for the purpose of illustration only and it is understood that improvements and modifications may be made without departing from the scope of the invention as defined in the claims set forth below.

CLAIMS

WE CLAIM:

1. A warp knit, weft inserted fabric comprising: warp yarns and weft inserted yarns connected thereto with stitch yarns and having the face thereof calendered to provide a surface roughness of less than 2.0 microns when the face thereof is covered with a thermoplastic film.

2. The fabric of Claim 1 wherein all of said yarns are polyester.

3. A coated fabric having a substrate and a film connected to face and back side thereof, said substrate having a warp knit, weft knit fabric with the face thereof calendered thereof to provide a surface roughness of less than 2.0 microns.

4. The coated fabric of Claim 3 wherein the back side thereof is calendered.

5. The substrate fabric of Claim 4 wherein said fabric is combined of 100% polyester yarns.

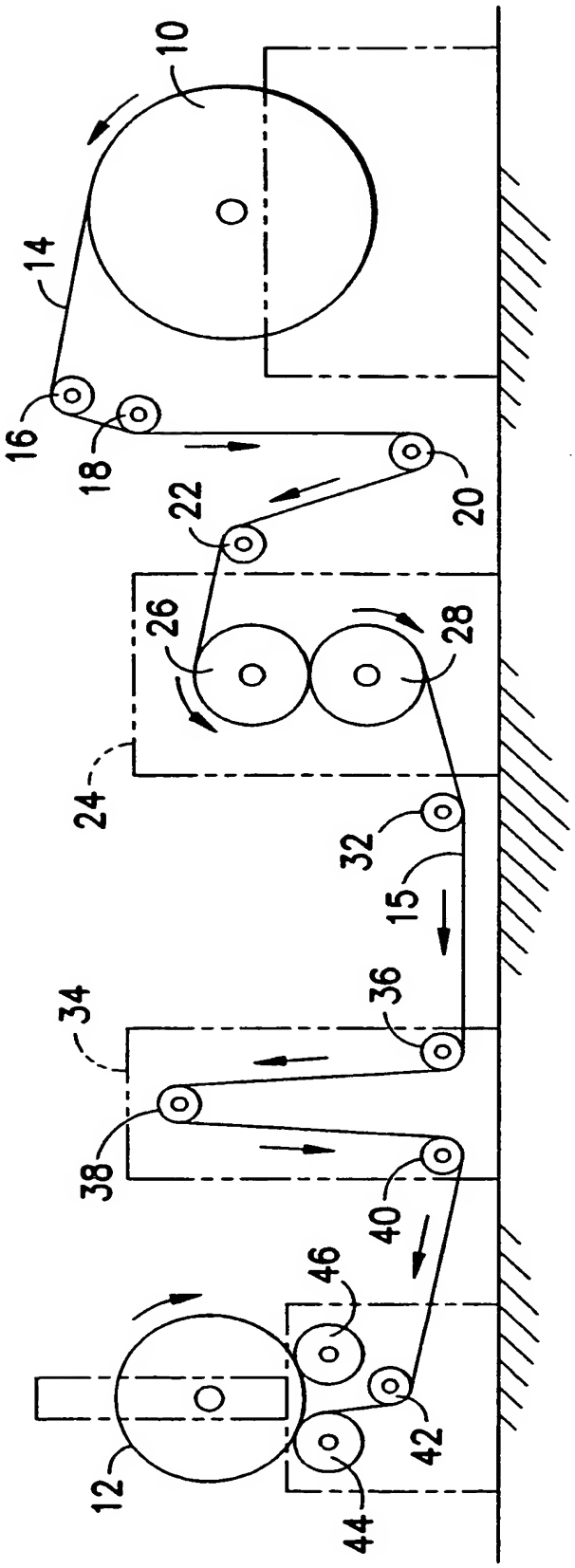

FIG. -1-

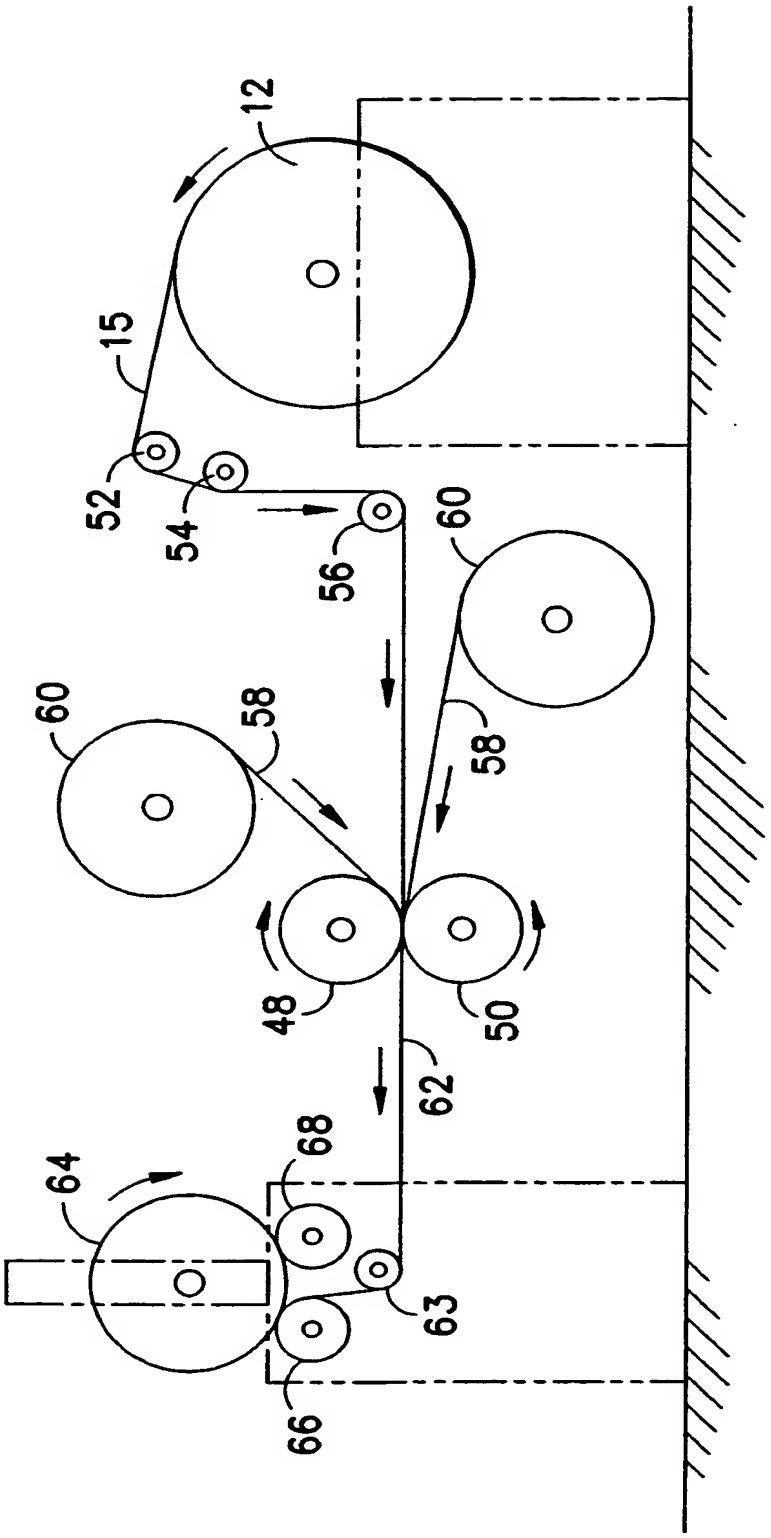

FIG. -2-

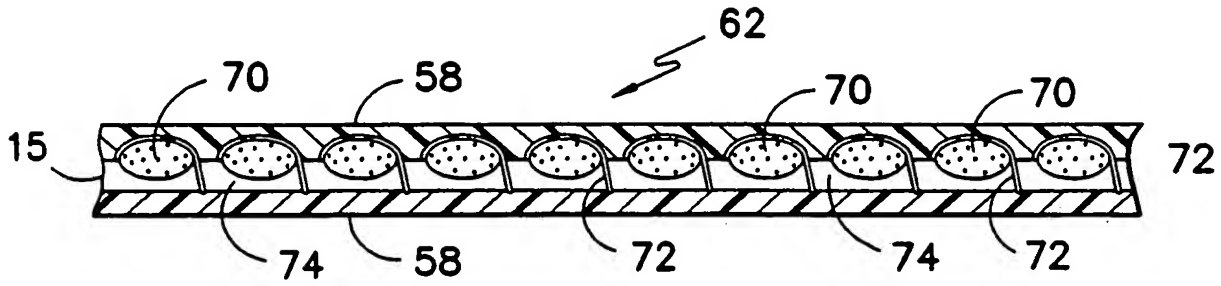

FIG. —3—

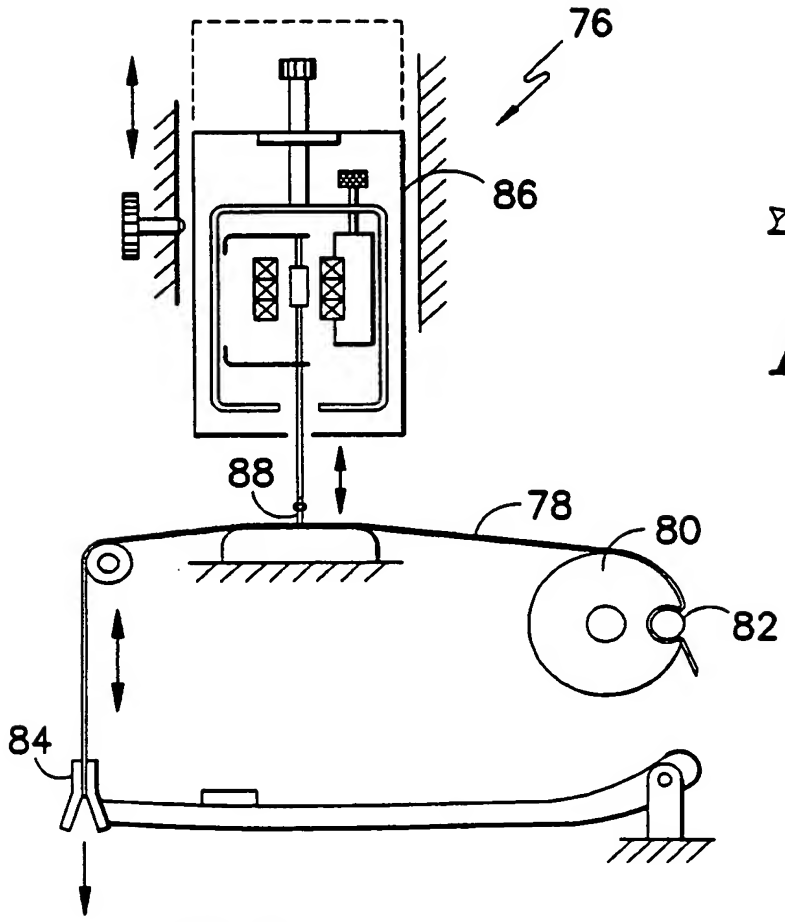

FIG. —4—

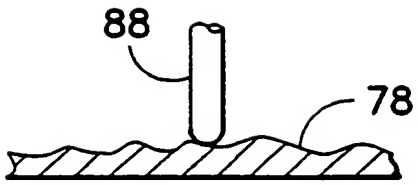

FIG. —5—

SURFACE ROUGHNESS (MEAN DEVIATION IN MICRONS)

FACE

	WARP FORWARD	WARP BACKWARD	AVERAGE
SAMPLE	8.46	5.93	7.20
A	1.85	1.95	1.90

FIG. —6—

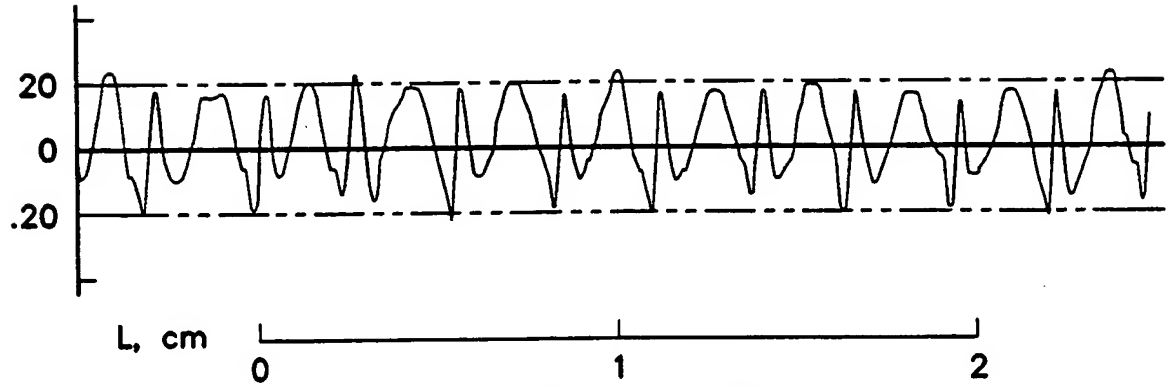

FIG. —7—

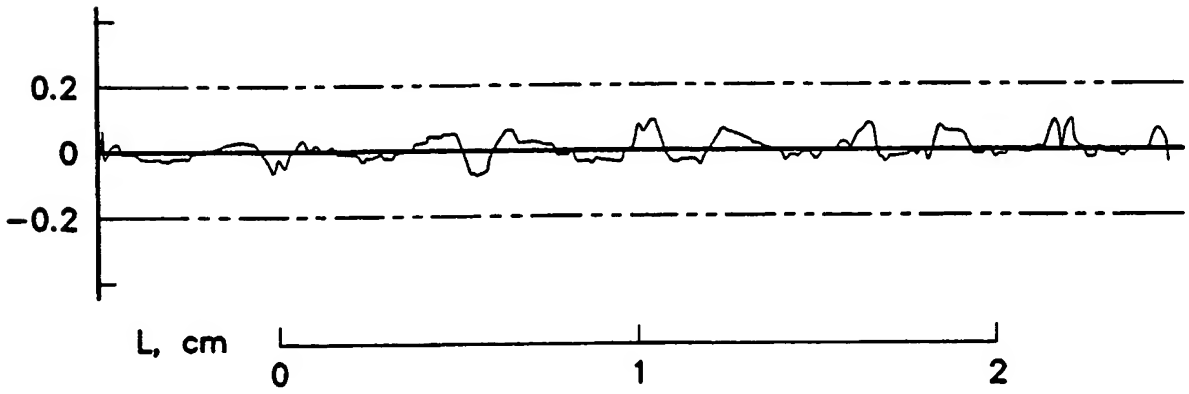

FIG. —8—

INTERNATIONAL SEARCH REPORT

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PCT/US00/16562

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :Please See Extra Sheet.
US CL : 442/195, 286, 288, 290

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 442/195, 286, 288, 290

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST calend$5 same (polyester same (thread or yarn or fiber or fibre or filament or strand), 442/195, 286, 288, 290.ccls.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,418,044 A (MAHLER) 23 May 1995, see entire document.	1-5
Y	US 5,571,605 A (ABRAMS et al.) 05 November 1996 see entire document.	1-5
Y	US 5,494,735 A (NITTA) 27 February 1996, see entire document	1--5
Y	US 4,438,167 A (SCHWARZ) 20 March 1984, see entire document.	1-5
Y	US 4,107,369 A (GARDNER) 15 August 1978, see entire document.	1-5
Y	US 6,056,479 A (STEVENSON et al.) 02 May 2000 see entire document.	1-5

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 28 JULY 2000	Date of mailing of the international search report 28 AUG 2000
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INTERNATIONAL SEARCH REPORT

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,307,144 A (SANDERS et al.) 22 December 1981 see entire document.	1-5

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A. CLASSIFICATION OF SUBJECT MATTER:
IPC (7):

B 32 B 27/12, 27/36
D 03 D 15/00